Institute for Health Sciences
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A data-driven approach for emphysema subtyping using Deep-learning based Clustering.

Deep Clustering Activation Maps for Emphysema Subtyping

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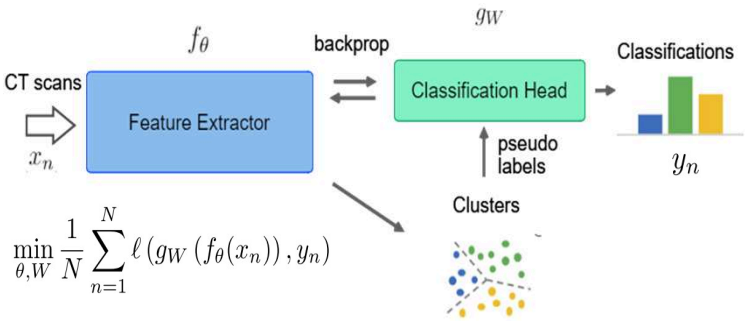
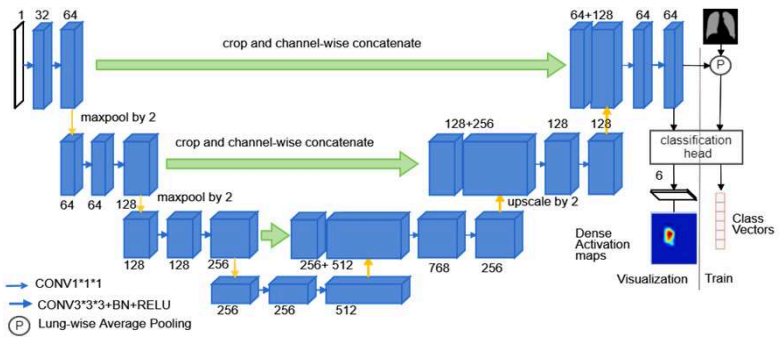
INTRODUCTION

Existing emphysema subtyping systems were defined mostly based on visual assessment of computed tomography (CT) scans and quantitative imaging features.

To be fully data-driven, we propose to use deep learning clustering that exploits dense features from a segmentation network for emphysema subtyping on CT data.



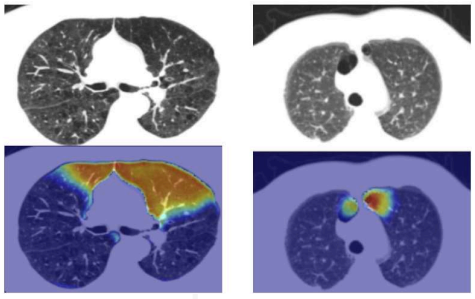
Training Strategy



Dense Feature Extraction Training and Evaluation

METHOD

- **Training Strategy:** Alternating between grouping the features with a standard k-Means. Then using the cluster assignments as classification supervision to update network weights.
- **Dense Features:** use dense feature maps from 3D-Unet before average-pooling with the lungs for classification training and without pooling for visualization.



Dense Activation Maps

Method	clustering accuracy	silhouette coefficient
baseline	41%	0.44
proposed	**43%**	**0.54**

Performance vs the baseline

RESULTS

- Achieved a 43% unsupervised clustering accuracy, outperforming the baseline at 41%.
- Offered a better cluster formation than the baseline, achieving 0.54 in silhouette coefficient.

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